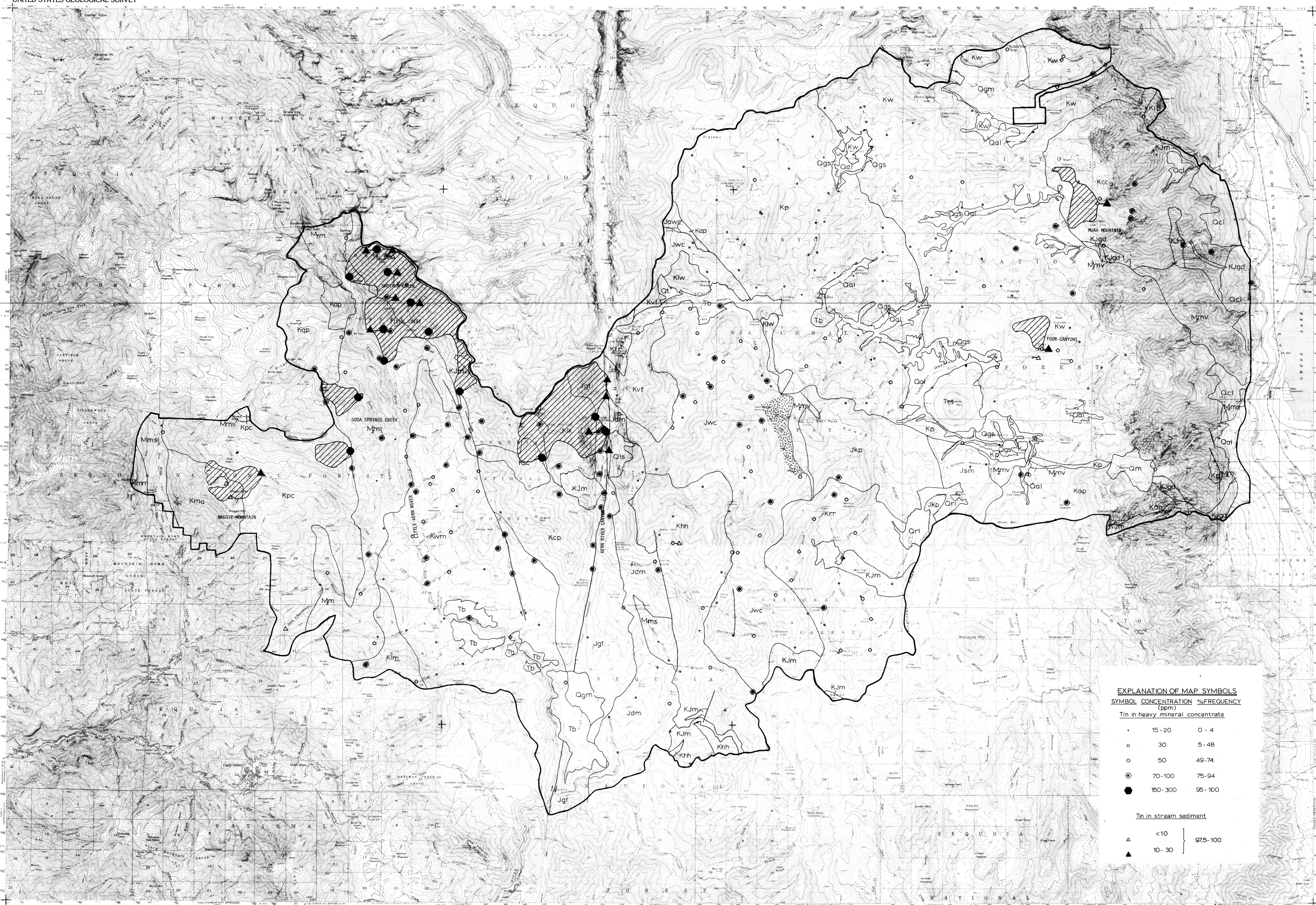
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
81-756



EXPLANATION OF MAP SYMBOLS

Tin in heavy mineral concentrate

SYMBOL	CONCENTRATION (ppm)	%FREQUENCY
+	15-20	0-4
○	30	5-48
⬡	50	49-74
⬡ (with dot)	70-100	75-94
⬢	150-300	95-100

Tin in stream sediment

SYMBOL	CONCENTRATION (ppm)	%FREQUENCY
△	<10	97.5-100
▲	10-30	

Base from U.S. Geological Survey, 1:24,000, 1956
Camp Nelson; Hockett Peak; Kern Peak;
Mineral King; Monache Mtn; Olancha

Geology from E. A. duBray, D. A. Dellinger, and J. G. Moore, 1977-79

SCALE 1:62500

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

MAP SHOWING DISTRIBUTION OF Sn IN STREAM SEDIMENTS AND HEAVY-MINERAL CONCENTRATES FROM THE GOLDEN TROUT WILDERNESS, CALIFORNIA

By

D.L. Leach, R.J. Goldfarb, and J.A. Domenico

1981

INTRODUCTION

This map shows the distribution of Sn in the minus-80-mesh (<180 μm) fraction of composited stream sediments and heavy-mineral concentrates collected in the Golden Trout Wilderness, California, during the summers of 1979 and 1980. Sites were chosen on first- or second-order drainages, as defined by 1:62,500 topographic maps. All sites on second-order drainages were chosen at least 100 m below any first-order stream junction. Sample sites were selected at a density of one site per cell, each cell having an area of approximately one square mile (2.6 km^2). Some cells may not contain a sample site because of various factors, such as lack of small-order-stream drainage or extreme relief.

At each site, five grab samples of stream sediment were collected along 10 m of active stream channel and composited into a single sample. These samples were air-dried and the minus-80-mesh (<180 μm) fraction was pulverized prior to analysis. A heavy-mineral concentrate was collected in the field using a standard gold pan. Commonly, 3 to 4 kg of composited sediment were necessary to yield the desired amount of concentrate. At the laboratory, the sample was air-dried, and the highly magnetic material was removed by a magnet. Any light-weight material remaining in the concentrate was then separated by allowing the heavier fraction to settle through bromoform (specific gravity 2.82). The resulting heavy-mineral fraction was then separated into a nonmagnetic fraction using a Frantz Isodynamic Separator[1], at a setting of 0.6 ampere, with 15° forward and 15° side setting.

The sediments and nonmagnetic heavy-mineral concentrates were analyzed semiquantitatively for 31 elements using an optical emission spectrograph, according to the method outlined by Grimes and Marranzino (1968). A complete tabulation of the data for each sample collected in the Golden Trout Wilderness is provided by Leach and others (1981). This report also presents a more detailed discussion of the sampling and analytical methods, and includes statistical summaries of the data.

The Sn content of the nonmagnetic heavy-mineral concentrates may reflect the distribution of cassiterite and other heavy minerals that contain Sn replacing normal lattice positions. The Sn content in the stream sediments also reflects the presence of Sn-bearing nonmagnetic heavy minerals as well as Sn in various rock-forming minerals (i.e. biotite), either as inclusion of Sn or as lattice substitutions.

RESULTS

A histogram of the Sn concentrations in the heavy-mineral concentrates is shown in figure 1 and some statistical estimates are given in table 1. Tin concentrations in most of the stream sediments were below the detection limit of 10 ppm; therefore, no histogram was plotted. The concentration ranges used to plot the Sn in heavy-mineral concentrates were arbitrarily selected to approximate the top 5 percentile, 95-75 percentile, 75-50 percentile, 50-25 percentile, and the lower 25 percentile. Because the spectrographic concentrations are reported as geometric midpoints of ranges in concentration, it is not possible to precisely divide the data into the desired percentiles. Therefore, the five symbols on the map represent slightly different percentiles. Most of the samples of stream sediment had Sn concentrations below the detection limit; therefore, only samples that contained detectable Sn in the range <10 to 30 ppm were plotted. To avoid overlap of the concentration symbols, the symbols for stream sediment were offset from the symbols for heavy-mineral concentrates.

Because the data consists of a number of populations derived from a variety of rock types, we arbitrarily chose the anomalous samples to approximate as closely as possible the top 5 percentile of the data; therefore, we define the anomalous concentrations of Sn in heavy-mineral concentrates to be 150-300 ppm; the top 5 percentile of the data. All of the stream-sediment samples that have detectable Sn concentration (at least 10 ppm) are considered anomalous (they would fall in the top 3 percentile).

On the map, we have outlined the stream catchment area that may have contributed material for the anomalous Sn concentrations. Many heavy-mineral concentrates with Sn concentrations within the upper quartile of the data (about 70 ppm) are in a region that includes the Little Kern River drainage east to the Kern River Canyon. Within this region are two areas that contain anomalous Sn concentrations in 10 stream sediments and 11 heavy-mineral concentrates. One area is located in the upper Little Kern River drainage near Pistol and Shotgun Creeks, and is underlain by metamorphic rocks of the Mineral King roof pendant and alaskite of Coyote Pass. The other area is located west of the Kern River Canyon, and is underlain by granite of Grasshopper Flat, granite of Little Kern Lake Creek, and granodiorite of Sheep Creek; numerous xenoliths and mafic dikes are also present. In addition, two stream catchment areas in the Little Kern River drainage, west of Soda Springs Creek, contain one anomalous heavy-mineral concentrate each. One of these is underlain by metamorphic rocks of the Mineral King roof pendant and the other is underlain by the granodiorite of the Pecks Canyon. Three anomalous stream sediments are located in a stream catchment area near Maggie Mountain, underlain by the alaskite of Maggie Mountain and granodiorite of Pecks Canyon. In the eastern part of the wilderness, there are two stream catchment areas that contain one anomalous stream sediment each. One of these is located near Four Canyons in the Cretaceous Whitney Granodiorite, and the other is located north of Muah Mountain in the granite of Carroll Creek.

[1]The use of trade names in this report is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

REFERENCES CITED

duBray, E. A., and Dellinger, D. A., 1981, Geologic map of the Golden Trout Wilderness Southern Sierra Nevada, California: U.S. Geological Survey miscellaneous Field Studies Map 1231-A.
Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for semi-quantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.
Leach, D. L., Goldfarb, R. J., and Domenico, J. A., 1981, Basic data report and geochemical summary for stream sediments, heavy-mineral concentrates, rocks, and waters from the Golden Trout Wilderness, California: U.S. Geological Survey Open-File Report 81-752.

LIST OF MAP UNITS

SURFICIAL DEPOSITS

- Qal — Alluvium
- Qcl — Colluvium
- Qgm — Glacial Moraine
- Qt — Talus
- Qg — Gravel
- Qls — Landslide Deposit
- Qgs — Grus and Sand

VOLCANIC ROCKS

- Qrl — Rhyolite of Long Canyon
- Tb — Basalt
- Trt — Rhyolite of Templeton Mountain

GRANITOID ROCKS
WESTERN REGION

- Kmm — Alaskite of Moses Mountain
- Kma — Alaskite of Maggie Mountain
- Kqp — Granodiorite of Quinn Peak
- Kpc — Granodiorite of Peck's Canyon

GRANITOID ROCKS
CENTRAL REGION

- Kwm — Granite of White Mountain
- Ksc — Granodiorite of Sheep Creek
- Kvf — Granodiorite of Volcano Falls
- Ktr — Granodiorite of Tower Rock
- Klm — Granodiorite of Loggy Meadow
- Kcp — Alaskite of Coyote Pass
- Klk — Granite of Little Kern Lake Creek
- Khh — Alaskite of Hell's Hole
- Jgf — Granite of Grasshopper Flat
- Jdm — Granodiorite of Doe Meadow
- Jwc — Granite of Window Cliffs

GRANITOID ROCKS
EASTERN REGION

- Klw — Granite of Little Whitney Meadow
- Kw — Whitney Granodiorite
- Kib — Intrusion Breccia of Timosea Peak
- Kp — Paradise Granodiorite

GRANITOID ROCKS
EASTERN REGION (CONT'D)

- Kcc — Granite of Carroll Creek
- Krr — Granodiorite of Redrock Meadow
- Kop — Alaskite of Olancha Peak
- Jawc — Alaskite of Window Cliffs
- Jwc — Granite of Window Cliffs (patterned area is a mafic phase)
- Jkp — Alaskite of Kern Peak
- Jsm — Granodiorite of Schaeffer Meadow

IGNEOUS ROCKS
(OF UNCERTAIN TEMPORAL & GENETIC AFFINITIES)

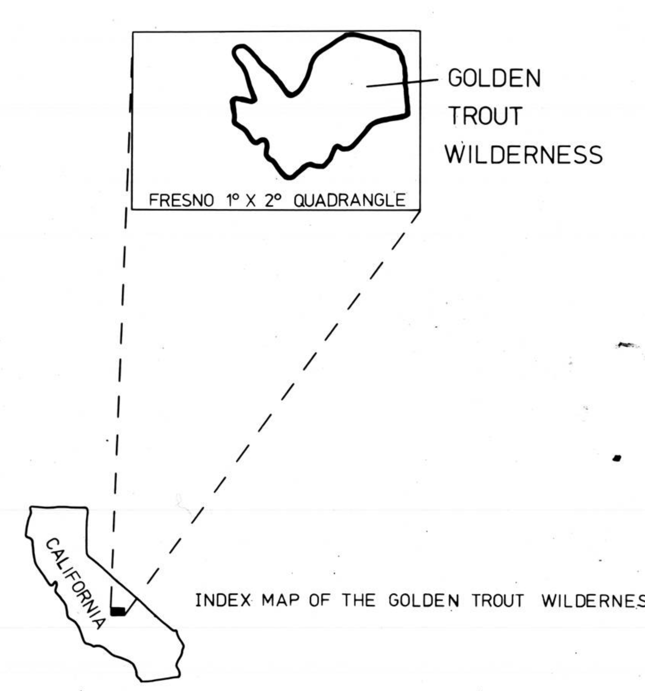
- Kap — Aplite
- KJm — Mafic Plutonic Rock
- KJgd — Granodiorite

METAMORPHIC ROCKS

- Mzms — Metasedimentary Rocks
- Mzm — Metamorphic Rocks, Undifferentiated
- Mzmv — Metavolcanic Rocks

(Geology from duBray and Dellinger, 1981)

- Boundary of Golden Trout Wilderness
- Geologic Contact
- Fault



INDEX MAP OF THE GOLDEN TROUT WILDERNESS

Table 1--Statistical summary of Sn concentrations in the heavy-mineral concentrates

Detection ratio*	1.0
Geometric mean (ppm)	44
Geometric deviation (ppm)	1.7
Expected range for 95 percent data (ppm)	15-134
Arithmetic mean (ppm)	52

*Number of uncensored values divided by the total number of samples

Studies Related to Wilderness

The Wilderness Act (Public Law 88-577, Sept. 3, 1964) and related Acts require the U.S. Geological Survey to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Golden Trout Wilderness, California.

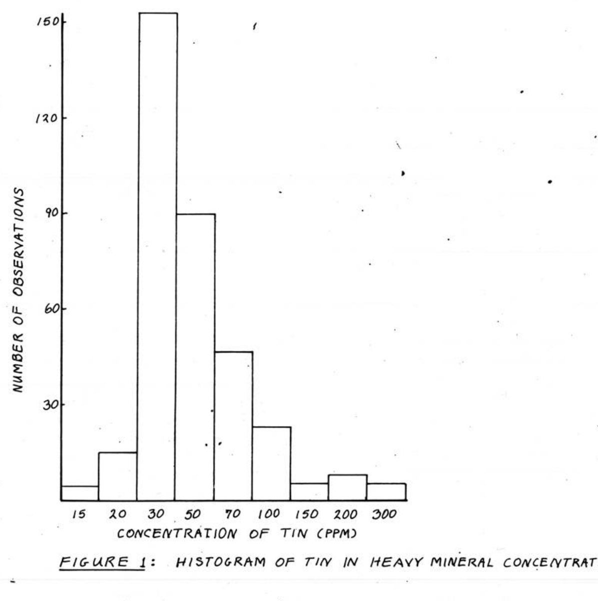


FIGURE 1: HISTOGRAM OF TIN IN HEAVY MINERAL CONCENTRATE.